2004 Stillaguamish Lead Entity Strategy

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Stillaguamish Implementation Review Committee

&

Washington State Salmon Recovery Funding Board

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Chinook salmon (*Oncorhynchus tshawytscha*) were listed as threatened under the federal Endangered Species Act (ESA) in March 1999. Substantial evidence has been accumulated to document the decline of chinook salmon in the Stillaguamish and throughout Puget Sound. This report describes the effects of historical land use on chinook salmon populations in the Stillaguamish watershed, and sets priorities for habitat restoration actions. These actions are intended to benefit multiple salmon species.

This strategy is intended to provide guidance to habitat project sponsors working in the Stillaguamish watershed - Water Resource Inventory Area (WRIA) 5 (Figure 1). It is intended to establish priorities for actions in the watershed and provide the basis for habitat project evaluation and ranking.

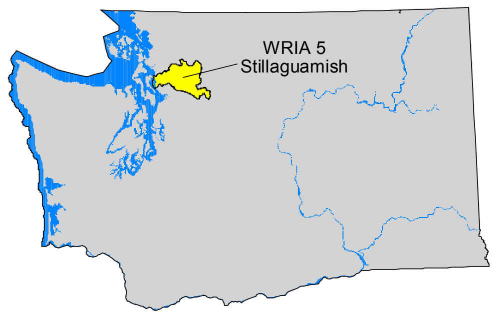


Figure 1. Location of Stillaguamish Watershed

Stillaguamish Lead Entity staff prepared this document after consultation and review by the Stillaguamish Implementation Review Committee (SIRC) – see Appendix B. The SIRC was established in 1990 as a local stakeholder group to oversee implementation of the nonpoint pollution oriented Stillaguamish Watershed Action Plan (WDOE 1990). The 25-member committee also serves as Stillaguamish Lead Entity citizen committee to prioritize habitat projects for consideration by the State Salmon Recovery Funding Board.[1]

The SIRC is also partnering with the Puget Sound Shared Strategy. The Shared Strategy is a regional group that is working with Federal agencies to develop a Puget Sound chinook salmon recovery plan that meets the intent of the ESA. This document outlines geographic priorities for voluntary habitat recovery actions that will be developed further as part of a Puget Sound salmon recovery plan. The Stillaguamish chapter of this plan will be drafted by June 2004. The Puget Sound Shared Strategy is compiling watershed plan chapters from 14 Puget Sound watersheds and nearshore areas. The Stillaguamish watershed plan chapter will also address policy requirements to achieve salmon recovery over the next 10 years.

This strategy explicitly prioritizes chinook salmon for voluntary habitat restoration actions. While the watershed stakeholders have a strong vision for broad ecosystem restoration, the determination that chinook salmon should be a clear priority for near-term restoration was based on the following factors:

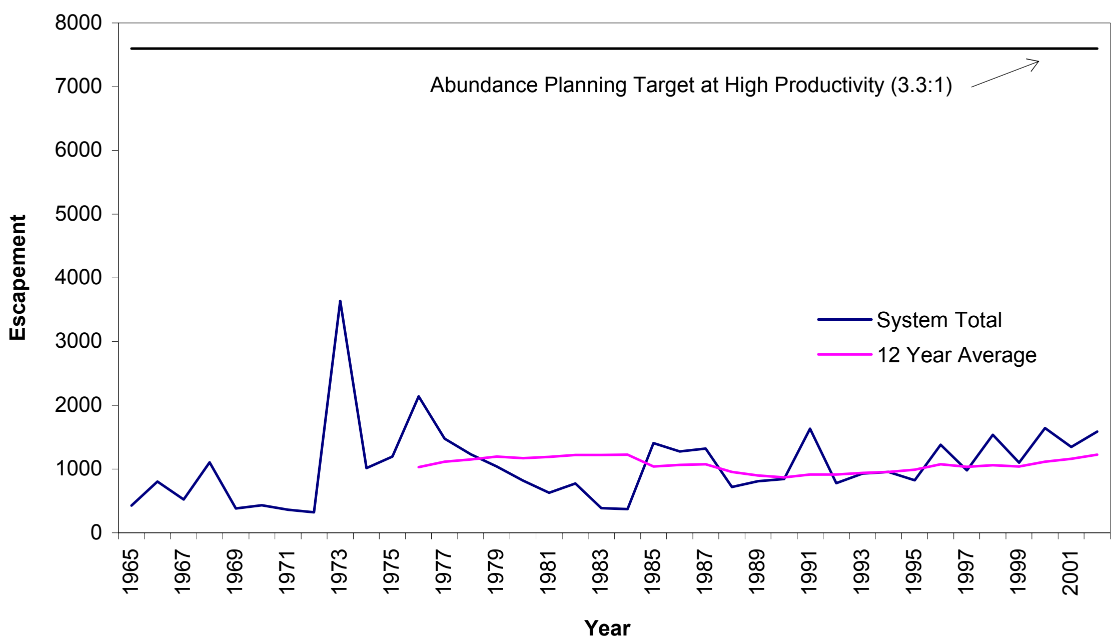
[1] A Lead Entity is local partnership between technical experts, a citizen committee and administrative staff. The Stillaguamish Tribe and Snohomish County co-lead the Stillaguamish Lead Entity. The SIRC acts as the citizen committee in partnership with the Stillaguamish Technical Advisory Group. For more information on Lead Entities see http://www.iac.wa.gov/srfb/leadentities.htm

- Chinook salmon are listed as threatened under the federal Endangered Species Act and are the focus of the recovery planning effort of the Puget Sound Shared Strategy.
- Chinook salmon are the most important salmonid species in terms of cultural and economic significance for tribes, fishermen and the SIRC.
- Chinook salmon recovery efforts over three decades have not met very modest co-managers targets (i.e. 2000 fish).
- While bull trout are also listed as threatened, less is known about what specific voluntary measures should be taken to address bull trout habitat needs. The United States Fish and Wildlife Service has developed a Puget Sound Recovery Plan on a separate track from the Puget Sound Shared Strategy process.
- The habitat and ecosystem processes that must be restored and protected for chinook salmon will benefit all other salmonids in the watershed including bull trout.

CHINOOK SALMON BACKGROUND

Two stocks of chinook salmon inhabit the Stillaguamish watershed. A North Fork summer stock and a South Fork fall stock that also utilizes the mainstem and Pilchuck Creek. The Stillaguamish Tribe currently supports the North Fork stock with a wild hatchery program. The current tribal natural stock restoration program contributes an estimated one-third of the returning adults to the spawning habitat within the North Fork of the Stillaguamish River. Less than 2000 spawning adult chinook salmon return each year which is about 20 % of the number needed for recovery (Figure 2).

Figure 2. Chinook Salmon Escapement 1965-2002[2]



[2] Puget Sound watersheds were given abundance targets for chinook salmon in 2002 that form the basis for recovery planning. The high productivity target of 7,600 fish represents the escapement (number of spawning fish) at the point where the population provides the highest sustainable yield for every spawner. Productivity is shown as number of adult fish recruits 3-5 years after a current spawning cycle.

Historically, agricultural and forestry land uses were the source of most habitat loss in the Stillaguamish watershed (Figure 3). Currently, losses of estuarine salt marsh and tidal channels have significantly reduced the quantity and quality of juvenile and adult salmonid habitat. This has been caused by historical reclamation of tidelands, constricted channels, and cut-off sloughs. Furthermore, the lack of mature streamside forest throughout the watershed has significantly reduced habitat quality.

Streamside and upland clearing has impacted the form of the river and made stream channels unstable. Clearing has also filled salmon holding pools, eliminated wetlands, and reduced large woody debris (LWD). Most of these impacts have been caused by logging and road building in the forest zones. These activities have also resulted in increased fine sediment loads and destructive peak flows, which are the primary cause of reduced salmon egg-to-fry survival.

Figure 3. General Map of Stillaguamish Watershed – WRIA 5

SUMMARY OF PRIORITY GEOGRAPHY

The stream reaches identified as priorities in this document have been organized in six main categories - riparian, estuarine, large wood, floodplain, sediment and hydrology. These categories correspond to limiting factors for chinook salmon populations in the Stillaguamish but are not meant to be mutually exclusive. The priority river reaches are based on the best available scientific information and are classified as such because they are important to chinook salmon populations specifically. Proposed actions will likely address multiple categories (i.e. multiple watershed processes).

Projects affecting all the above habitat categories are essential if salmon recovery is to take place. Priorities for restoration and protection focus on key reaches where chinook salmon are currently productive. These production reaches include spawning grounds, migration corridors and rearing areas. Priority areas were determined by both understanding which stream reaches were most important to the chinook salmon population and the degree to which upstream ecosystem processes were affecting downstream conditions. The following priorities are discussed in more detail in Chapter 4 of this document:

Riparian

A properly functioning streamside or riparian forest provides shade and cover for salmon, stabilizes stream banks, controls sediment, attenuates flooding impacts, and contributes large woody debris (LWD) and other forms of organic matter. These functions are important in reaches where chinook salmon live and in upstream areas that drain to chinook reaches. Control of water temperature and large wood recruitment are particularly important ecosystem processes in higher elevation watersheds.

Priority reaches for riparian restoration and protection are the North Fork and South Fork Stillaguamish and Lower Pilchuck Creek. A priority emphasis is on non-forest lands where restoration is needed to supplement existing regulatory programs already in place to provide riparian function.

Estuarine

An estuary is an important feeding area where young salmon make the transition from freshwater to saltwater. Chinook salmon use estuaries to grow and gain strength before they migrate to the open ocean. Vital estuarine habitat include blind tidal channels, eelgrass beds, tidal sloughs and shallow shoreline areas.

Existing estuarine project sites owned by The Nature Conservancy and The Washington Department of Fish and Wildlife (WDFW) adjacent to Port Susan are priorities for immediate restoration. Additional priorities should be identified in partnership with the Stillaguamish Flood Control District, which manages flood control operations in the area.

Large Wood

When trees fall into streams, the large wood pieces help create a rich mosaic of river channel habitat. Large wood creates pools and cover for salmon and provides habitat for insects that are food for juvenile chinook salmon. Wood placement is also a suitable technique to stabilize large landslides near rivers and direct flow to enhance instream habitat.

Priority reaches for placing groups of large wood (i.e. log-jams) on the North Fork and South Fork Stillaguamish River are where gaps exist between areas of functioning habitat. Engineered log-jams should also be built to reduce the sediment contribution from deep-seated landslides at Steelhead Haven and Gold Basin.

Floodplain

River segments with broad floodplains are some of the most productive habitats for salmon. Salmon take refuge in off-channel areas adjacent to floodplains of larger rivers during winter flood events. These are key holding and rearing areas for outmigrating juvenile and spawning adult chinook salmon.

Priority reaches for floodplain restoration and protection include areas downstream of key spawning areas with opportunities for floodplain reconnection. These reaches include all of the North Fork Stillaguamish downstream to the Koch Slough confluence with the lower Stillaguamish mainstem channel. Lower reaches of the South Fork Stillaguamish and Pilchuck Creek are also priorities.

Sediment

Sediment washed from uplands and eroded from stream channels determines the nature and quality of salmonid habitat in streams, rivers, and estuaries. In the freshwater environment, the quality (gravel size and fine sediment composition) and stability of chinook salmon spawning habitat are key factors affecting chinook salmon production.

Priority sediment projects include landslide stabilization at Steelhead Haven on the North Fork Stillaguamish River and Gold Basin on the South Fork Stillaguamish River. Forest road sediment sources in the Deer Creek, Upper North Fork Stillaguamish River, Robe Valley, French-Segelson and Middle North Fork Stillaguamish River subbasins are also priorities.

Hydrology

The natural level and timing of river flows is important for creating and maintaining suitable habitat conditions. During high flow events, spawning gravel can become suspended in the water column and moved downstream, a process known as scour. Adequate minimum flows are also essential for spawning migration.

Restoration and protection of floodplains, including significant connected wetlands, in the upper reaches of the North Fork Stillaguamish River is a priority.

COMMUNITY ISSUES

A successful strategy depends on a supportive community with willing landowners. The SIRC has identified the following community issues that must be considered in the salmon conservation strategy.

Agricultural Viability: Many sensitive stream and river habitats need to be enhanced on or near agricultural lands. Incentives must be in place to allow farmers to participate in salmon habitat restoration and protection while keeping farms viable and preventing more intensive land uses.

Floodplains: The ability for upstream floodplain restoration to provide benefits to fish and downstream human infrastructure is important to the Stillaguamish community and the

SIRC. The potential for storage of peak flows in the lower reaches of the North Fork and South Fork Stillaguamish is particularly relevant.

Water Quality: Initiatives to protect and restore water quality were the foundation of the SIRC. The Stillaguamish community has worked hard for 15 years to clean up the watershed for all citizens. It is an objective of the SIRC that parallel efforts continue on water quality initiatives while salmon recovery work progresses.

Tribal Fishing Rights: The Stillaguamish Tribe of Indians has a deep cultural and economic interest in viable salmon populations that is protected by law. The Tribe will continue to be a key partner for salmon recovery and one with a special stake in its success.

Forestry: Forest harvest, forest road building and forest practice activities on steep slopes and riparian areas need to be conducted with full consideration of habitat conditions. Recent changes to the Washington State forest practice rules are encouraging. However, new forest practices must be funded, implemented and monitored if the changes are to be effective.

Land Use Regulation: Voluntary habitat restoration will not be effective if environmental degradation continues due to population growth and urban/suburban development. Adequate refinement and enforcement of local land use regulations and growth management policies are a crucial foundation for habitat restoration and protection.

2. INTRODUCTION

A. PURPOSE AND ROLES

The 2004 Stillaguamish Lead Entity Strategy is intended to provide guidance to habitat project sponsors working in the Stillaguamish watershed – Water Resource Inventory Area (WRIA) 5. The Salmon Recovery Funding Board (SRFB) may also use this document to evaluate the fitness of individual projects proposed for funding in the 5th Grant Cycle and subsequent funding cycles. This document defines criteria for taking action to restore and protect key habitat functions in the watershed. It represents the latest compilation of research and analysis from various agencies and organizations focused on salmon recovery in the Stillaguamish.

The assumptions of the strategy are stated below along with the dual purpose of the document. Chapter 3 provides an overview of the watershed, salmonid species, the status of chinook salmon and relevant community issues. Chapter 4 describes the restoration priorities for distinct habitat condition categories.

This document proposes a voluntary action strategy for protecting and restoring riparian, instream wood, estuarine, sediment, hydrologic and floodplain conditions. These habitat elements or categories correspond to limiting factors in the Stillaguamish watershed and recognized types of projects. Although these categories are used to organize the document, many projects address multiple habitat elements.

Stillaguamish Implementation Review Committee

This document was prepared after consultation and review by the Stillaguamish Implementation Review Committee (SIRC). The SIRC was established as a local stakeholder group to oversee implementation of the 1990 Stillaguamish Watershed Action Plan. The Action Plan included seventy-one recommendations for controlling non-point source pollution in the Stillaguamish watershed. Currently, the committee has 25 members and has expanded its scope to include salmon recovery.

"The mission of the SIRC is to restore and maintain a healthy, functioning Stillaguamish watershed by providing a local forum in which agencies, organizations, communities, and the public can engage in a collaborative watershed based process of decision making and coordination."

The SIRC develops water quality initiatives, acts as the Stillaguamish citizen committee that prioritizes salmon habitat projects for the Washington State Salmon Recovery Funding Board, and is partnering with the Puget Sound Shared Strategy to develop a Stillaguamish recovery plan chapter for the Puget Sound Chinook Salmon Recovery Plan.

Lead Entity

The Stillaguamish Tribe and Snohomish County are designated as a co-lead entity under the State Salmon Recovery Act – *RCW 77.85*. The guidance to Lead Entities from the SRFB is clear: "Strategies should establish priorities for actions in the watershed(s) and provide a project evaluation and ranking process for actions based on these priorities. Lead Entities should not submit projects that cannot be supported by their strategy..." "If the strategy is more developed or focused in one area of the watershed or for one class of restoration or protection action, then proposed projects should be confined to these areas."[3]

Previously, the Stillaguamish Lead Entity strategy was contained in the *Technical Assessment and Recommendations for Chinook Salmon Recovery in the Stillaguamish Watershed* (STAG 2000). The Stillaguamish Technical Advisory Group of the SIRC published this comprehensive summary of salmon life history, limiting factors and factors of decline in 2000. This Lead Entity Strategy builds on this earlier work by incorporating new data and defining the priority geography for chinook salmon projects. The SRFB is currently the most reliable source of funding for large-scale habitat projects that are oriented to chinook salmon recovery.

Shared Strategy

The Puget Sound Shared Strategy is compiling watershed plan chapters from fourteen Puget Sound watersheds and nearshore areas. The SIRC is partnering with the Shared Strategy and has agreed to submit a draft plan chapter by June 2004. The watershed plan chapter (Stillaguamish Salmon Conservation Plan) will address both voluntary and policy elements of chinook salmon recovery over the next ten years and will evolve from this lead entity strategy.

B. ASSUMPTIONS AND PRIORITIES

Assumptions

This document uses the following assumptions:

Chinook Salmon Focus: The strategy will have a clear preference for projects that restore and protect habitat and ecosystem processes that benefit chinook salmon. This does not diminish the goals and objectives of the SIRC or the need for ecosystem-based restoration.[4] Rather, chinook salmon are recognized as the most important species in the watershed and the one that deserves priority attention. Projects intended to restore ecosystem processes and habitats for chinook salmon will have many positive benefits for other species.

Voluntary Actions: This strategy focuses on prioritizing specific reaches for voluntary habitat protection and restoration actions. These voluntary actions address community concerns that projects must rely on willing landowners, scientific justification and efficient use of public resources.

[3] SRFB 2003
[4] See appendix A for more detailed background on the SIRC and its goals and objectives.

Policy Actions: Urban, rural and forest land use policy, community outreach and other programmatic actions are an important part of comprehensive salmon recovery but are not the focus of this strategy. These will be described later in the Recovery Plan chapter after consultation with the various relevant agencies and departments.

Stream Reach Scale Priorities: [5] This strategy defines subbasin and stream reach scale priorities only. Site-specific detail will need to be developed as part of project feasibility, defined in the recovery plan chapter or applicable local jurisdiction or agency long range plans.

Ten Year Time Frame: The focus of this strategy is to prioritize actions within the one to ten-year period only. The full benefits of these actions for salmon populations may not be entirely realized for 50-100 years. This strategy will need to be updated, as new information is developed.

Priorities

The limiting factors analysis identified key Chinook habitat elements to be protected and restored. The geographic priorities in this document are organized according to these habitat elements. In some cases a second tier priority is described when there is a clear distinction between two different areas of the watershed. In the case of instream passage, the statement of priority is indefinite due to the fact that existing data has neither identified chinook salmon specific needs nor excluded them.

5 A "reach" is generally defined as a length of a tributary or mainstem river with associated riparian areas. This is contrasted to the subbasin or watershed concept that denotes the land that drains to a particular stream or river.

3. WATERSHED OVERVIEW

A. PHYSICAL SETTING

The Stillaguamish River drains approximately 700 square miles and includes more than 3,112 miles of stream, river and marine shore habitat for salmon (Figure 4). The river enters Puget Sound at Stanwood, 16 miles north of Everett in northwest Snohomish County. Elevations in the watershed range from sea level to about 6,854 ft on Three Fingers Mountain. The Stillaguamish watershed can be divided into three sub-watersheds, the North Fork and South Fork and mainstem. The two forks join in Arlington, 18 river miles from the mouth. The North Fork drains an area of 284 square-miles. The South Fork is very similar in size draining 255 square-miles, or 36% of the Stillaguamish watershed. (Table 1).

Table 1. Stillaguamish Sub-Watershed Drainage Areas

Region	Drainage Area
North Fork	41% *(includes Deer Creek - 10% of Stillaguamish)*
South Fork	36% *(includes Canyon Creek - 8% of Stillaguamish)*
Mainstem	23% *(includes Pilchuck Creek - 11% of Stillaguamish)*

1. Climate

The climate is typically maritime with cool, wet winters and mild summers. Rainfall is highly variable throughout the watershed. Average annual rainfall ranges from 30 in/yr in the western portion of the watershed to 150 in/yr at higher elevations in the eastern portion of the watershed (Pess et al. 1999). Approximately 75% of the precipitation falls between October and March. Precipitation and streamflows are highest in late autumn and winter as a result of rainstorms and rapid snowmelt during warmer rainstorms (called rain-on-snow events). During the summer dry period, the lowest flows occur usually from July through October.

2. Geology

The geology of the Stillaguamish watershed is described in Collins (1997). High grade Mid-Cretaceous to Paleocene melange rocks dominate west of the Darrington Fault. East of the fault, the primary rock type is Darrington Phyllite, a mechanically weak rock that dominates the upper North Fork Stillaguamish. Crystalline rocks of the Oligocene Squire Creek Stock form the south side of the North Fork and the north side of the upper South Fork Stillaguamish. Glacial outwash from the Puget Lobe of the Cordilleran ice sheet forms the fork terraces and topography of the lower watershed. Alluvial deposits are inset within the terraces and valleys of the lower watershed. The Stillaguamish mainstem flows through an alluvium-floored valley, 1-2 miles wide, inset within terraces of glacial outwash.

3. Vegetation

Forests in the lower elevations of the Stillaguamish watershed are characterized by western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), and western red cedar (*Thuja plicata*). Deciduous species found in the lower elevations include red alder (*Alnus rubra*), black cottonwood (*Populus trichocarpa*), and bigleaf maple (*Acer macrophyllum*). Pacific silver fir (*Abies amabilis*) is found at the mid-elevations and sub-alpine fir (*Abies lasiocarpa*) is found at higher elevations (Franklin and Dyrness 1973).

4. Forest History

Forest structure and landscape patterns changed considerably during the 1,000 years prior to European settlement, primarily due to the occurrence and patterns of large, stand-replacing fires occurring at intervals of 200 to 300 years. Peter (1999) assessed the upper Stillaguamish, within or adjacent to National Forest lands, and found that the upper basin has experienced several large, historic fires. Around 12,602 acres burned in the year 1000; while in 1300 and 1308, large fires burned over 69,931 acres across the upper watershed. In 1508, fires burned approximately 43,984 acres in the Texas Pond area, Canyon Creek area, and much of the upper South Fork Stillaguamish. Another large fire in 1701 burned over 41,020 acres primarily along the lower slopes of the upper river valley.

This pattern of fire occurrence converted large areas from older forests to early-seral forest in a matter of days. Fires in riparian areas reduce shade and sources of instream wood, resulting in increased erosion, loss of nutrients, and stream warming. Large fires occurred during much drier climates than exist today and set the stage for current forest conditions. From 1900 to the present, records show that only relatively small fires have burned, and were most likely associated with human activity.

Splash dams were used in early logging operations throughout the upper Stillaguamish watershed on both the North and South Forks of the river. Log crib dam construction on streams formed complete blockages to upstream migration of adult salmon and trout. Subsequent dam breaching caused complete destruction of riparian habitat and instream structure. Even though the last splash damming occurred in the early 1900s, there are effects that can be seen today.

5. Floodplain Changes

Past efforts to reclaim tidelands, constricted channels, and cut-off sloughs has considerably reduced the quantity and quality of salmonid rearing habitat. Historical removal of log-raft jams has destabilized channel banks and degraded the channel bed by increasing stream gradients and velocities. Removal has also led to the release of large quantities of stored sediment. Down-cutting of the channel bed exacerbates the disconnection of channel and floodplain.

Channels have become shorter and straighter due to bank protection, levee and dike construction, railroad grade construction, and channel filling. These alterations increase water velocity and, for the same discharge, may lead to increased flooding. These measures also decrease the area that could potentially receive floodwaters, increasing the cumulative potential for catastrophic floods downstream.

6. Current Population and Land Use

Land use within the Stillaguamish watershed is 76% forestry, 17% rural, 5% agriculture, and 2% urban (Figure 5 – Snohomish County 1995). However, streamside land use adjacent to salmon and trout streams is 61% forestry, 22% rural, 15% agriculture, and 2% urban (Pess et al. 1999).

Forestry: Federal, state, and private forestland uses occupy most of the watershed. Timber harvest in steep headwaters has and continues to cause channel widening and significant sediment loads in tributaries of the North Fork and South Fork Stillaguamish River. In addition, forestry-related road building significantly contributes to fine sediment in downstream habitat. The management of riparian zones in forestland headwaters is key to maintaining natural streamflows, cool water and stable channels.

Agriculture: Farming is the most prevalent land use in the lower floodplain of the Stillaguamish watershed. Flood control, drainage infrastructure, and riparian/wetland area management impact adjacent habitats. Existing dikes and revetments installed to protect agricultural lands from floods and tidal influences limit chinook salmon productivity by restricting the movement of the river across its floodplain. Protection, restoration, and management of riparian areas and wetlands within the lower floodplain are important to salmon recovery.

Urban/Rural: Currently, Snohomish County has a human population of nearly 637,500 and is growing at an annual rate of 2.7%.[6] Continued population growth will place increasing pressure on streamflows, water quality and aquatic habitat as more land is densely developed. The cumulative effect of converting forest and agricultural lands to rural residential uses will diminish other ongoing salmon recovery efforts.

[6] As of April 2003, according to the Washington State Office of Financial Management (OFM).

B. BIOLOGICAL PROCESSES AND CONCEPTS

1. Salmonid Stocks Summary[7]

Chinook Salmon

Biologists group Stillaguamish chinook salmon (*Oncorhynchus tshawytscha*) into two stocks. They are distinguished by the timing, and to a lesser degree, the location of their spawning. In March 1999, these and other Puget Sound chinook salmon stocks were designated as threatened under the federal Endangered Species Act (ESA). The Washington State Salmon and Steelhead Stock Inventory (SASSI) lists both stocks as depressed.

Chinook salmon use the mainstem, North Fork and South Fork, as well as several of the larger tributaries (Pilchuck, Jim, Canyon, Squire, French, and Boulder – Figure 6). They begin entering the river in June and spawn from mid-August through October. The summer stock spawns mainly in September in the North Fork while the fall stock spawns mainly in October in the mainstem and South Fork.

Juvenile chinook salmon rear throughout the river system. Fry spend from one to five months in fresh water before migrating to the estuary. Outmigration for both stocks occurs mostly from mid-March through June. Less than 2% of the Stillaguamish chinook salmon are stream type that rear for one year in freshwater (Griffith et al. 2003).

Coho Salmon

The SASSI identifies two distinct coho salmon (*Oncorhynchus kisutch*) stocks: Stillaguamish and Deer Creek. The former is considered a mixture of native and non-native fish because of releases of hatchery coho salmon from the early 1950s to 1981. This stock is classified by SASSI as depressed. The Deer Creek stock is a native stock. Its stock status is unknown. The Stillaguamish Tribe operates a coho salmon brood stock program with fish derived from naturally and hatchery spawned adults.

Coho salmon return to the Stillaguamish River in September and October, and generally spawn from mid-November through January. They spawn in almost all accessible tributary streams in the Stillaguamish River system, preferring smaller streams with stable streamflow and gravel-sized substrate (Miller and Somers 1989).

Coho salmon fry emerge in March and April, and spend a full year in the watershed before migrating as smolts to salt water (Miller and Somers 1989). Juvenile coho salmon rear throughout the watershed, preferring small streams, side channels, wetlands and beaver ponds. Between 1986 and 1989, the annual coho salmon smolt production estimates from the Stillaguamish watershed averaged 649,081 and ranged from a high of 826,297 (1986) to a low of 514,680 (1989) (Nelson et al. 1997).

[7] Stock information is taken from SASSI (1993), SaSI (1998) and WCC (1999) unless otherwise noted.

Chum Salmon

The Stillaguamish chum salmon (*Oncorhynchus keta*) are geographically separated into two stocks: North Fork and South Fork. There is also some difference in the timing of spawning. Chum salmon enter the river from September through December. Spawning occurs from mid- to late October through December. Chum salmon prefer to spawn in side channels and in larger tributary streams. Chum salmon fry emerge in March through May, and like pink salmon, they leave the freshwater system almost immediately (Miller and Somers 1989). Unlike pink salmon juvenile chum salmon may linger in the estuary for up to three months before migrating into Puget Sound.

Pink Salmon

Pink salmon (*Oncorhynchus gorbuscha*) in the Stillaguamish watershed are separated into two stocks; North Fork and South Fork. The genetic distinctions between the two stocks are unknown. This species is believed to be native to the Stillaguamish. There is no record of hatchery introductions. Pink salmon are listed by SASSI as healthy.

Pink salmon enter the river on odd-numbered years from early August through early October. They are also found in the river on even-numbered years in limited numbers. The spawning season for pink salmon begins in late August and peaks in mid-October. Spawning mainly occurs in the North Fork and the South Fork and in larger tributaries (especially Squire, Boulder, Jim, and Pilchuck). Other tributaries are also used for spawning when sufficient flow is present. Pink salmon fry emerge from the gravels in March and leave the river almost immediately.

Steelhead Trout

Four steelhead trout (*Oncorhynchus mykiss*) stocks have been identified in the Stillaguamish watershed, including one winter run and three summer runs. The winter run is heathly according to SASSI, summer runs are critical or unknown. Juvenile steelhead trout rear between one and three years in freshwater before departing for Puget Sound (Miller and Somers 1989). The pools of small quiet streams and beaver ponds are important for the young fry, but as the fish grow in size they are able to use the higher energy stream environments.

Spawning occurs mainly in the North Fork and South Fork. The primary spawning tributaries include: Pilchuck, Boulder, Squire, Jim and Canyon. Approximately 100,000 to 130,000 hatchery winter steelhead trout smolts and 80,000 hatchery summer steelhead trout smolts are annually released into the Stillaguamish River. Smolts migrate out of the river from March through late June.

Sockeye Salmon

There is a small population of river sockeye salmon (*Oncorhynchus nerka*) inhabiting the Stillaguamish. Whether they are strays from other watersheds or a genetically distinct stock is not known. They are known to spawn in the upper North Fork, as well as several tributaries including Jim, Deer, Squire and Boulder. Sockeye salmon generally enter the river from July through September and spawn from August through October. Smolts migrate out of the river from March through June.

Bull Trout

Native char include both Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*). Char are presumed to be found throughout the watershed and use many habitat types during their lives. The SASSI stock status is listed as unknown. The US Fish and Wildlife Service (USFWS) has listed the Puget Sound bull trout as threatened under the federal Endangered Species Act. Although no systematic survey has been completed, most bull trout are believed to reside in Canyon Creek or the upper South Fork and its headwater streams. They are also found in Boulder, Squire and Deer Creek in the North Fork drainage.

Sea-run Cutthroat Trout

Sea-run (*Oncorhynchus clarki clarki*) and resident stocks of cutthroat trout are found throughout mainstem tributary habitats in the Stillaguamish watershed, although there has been no systematic inventory of their populations. Resident cutthroat trout, along with rainbow trout and brook trout, have been stocked in many lakes in the watershed (USFS 1995). Sea-run cutthroat trout begin entering the Stillaguamish in late July. Spawning occurs in mid-February through mid-May. Sea-run cutthroat trout typically rear from two to four years in freshwater before migrating to salt water, where they spend about two to five months before returning to the watershed (Spence et al. 1996).

Priority Stock

The Stillaguamish Lead Entity Strategy explicitly prioritizes chinook salmon (*Oncorhynchus tshawytscha)* for near-term voluntary habitat protection and restoration actions. While the watershed stakeholders have a strong vision for broad ecosystem restoration, the determination that chinook salmon should be a clear priority for near-term restoration was based on the following factors:

- Chinook salmon are listed as threatened under the federal Endangered Species Act.
- Chinook salmon are the focus species for the recovery planning effort of the Puget Sound Shared Strategy.
- The habitat and ecosystem processes that must be restored and protected for chinook salmon will benefit all other salmonids in the watershed.
- Chinook salmon are the most important salmonid species in terms of cultural and economic significance for tribes, fishermen and the SIRC.
- Chinook salmon recovery efforts over three decades have not met very modest co-managers targets (i.e. 2000 fish).
- While bull trout are also listed as threatened, much is unknown about what specific voluntary measures should be taken to address bull trout habitat needs. USFWS has developed a Puget Sound Recovery Plan on a separate track from the locally based Shared Strategy process.
- Other salmonid stocks in the Stillaguamish watershed are healthy or poorly understood remnant populations. Coho salmon stocks, while listed in SASSI as depressed, are now proposed as a healthy stock in the Stillaguamish.

2. Chinook Salmon Characteristics

North Fork (Summer) Chinook Salmon

North Fork chinook salmon are the predominant chinook salmon stock in the Stillaguamish watershed. On average, 60 to 80 % of the chinook salmon production for the watershed is believed to be North Fork chinook salmon (PFMC 1997). These fish typically begin returning to the river in June, with the last fish spawning by the end of September. The majority (80%) of the north fork chinook salmon spawn in the middle and upper sections of the North Fork Stillaguamish, with limited numbers of fish using the larger tributaries (Boulder, Squire, and French) for spawning.

Pess and Benda (1994) documented a strong association between pool habitat and spawning location. Areas of the river that have usable spawning habitat, but no pool habitat have very limited spawning. Approximately 44% of all chinook salmon spawning occurs within 115 ft of a pool, even though pool spacing averages one every 984 ft. Pess et al. (1999) documented a 38% loss of pool habitat in the North Fork since 1950.

North Fork chinook salmon select spawning areas that are associated with tail outs, riffles, and bars in the deeper portions of the low flow channel area. These spawning locations put their redds at high risk for impacts from late fall and winter flooding.

North Fork chinook salmon females typically lay 3,000 to 5,000 eggs in one or more nests. Nests are generally located in gravel 1 to 3 inches in diameter, and eggs usually are buried in gravel up to 10 in deep. In the Stillaguamish River, chinook salmon eggs should reach the eyed stage from late September through mid-October and should hatch from late October through mid-November. Emergence from the gravel usually occurs during December and January.

South Fork (Fall) Chinook Salmon

The few small populations of South Fork chinook salmon can be found in Jim Creek, Pilchuck Creek, and the lower portion of the South Fork Stillaguamish. South Fork chinook salmon also are infrequently found in French Creek and Canyon Creek.

South Fork chinook salmon tend to enter the river later than the North Fork stock, with fish arriving on the spawning grounds during mid-September and completing their spawning by mid-October. South Fork chinook salmon are more likely to use the larger tributaries and lower portions of the main river for spawning areas. In general, South Fork chinook salmon prefer to lay their eggs in areas of subsurface upwelling, along the bars and tail outs of pools.

There are several possible explanations as to why there is limited South Fork chinook salmon production in the Stillaguamish. South Fork chinook salmon are more likely to use larger tributaries in the watershed, which are prone to lower flows and warmer temperatures during the fall chinook salmon return period; this can lead to physical and thermal blocks to migration. In addition, many of the larger tributaries have experienced considerable habitat degradation. Upland erosion and landslides have increased fine sediments, streambed instability, pool habitat loss, and water temperatures.

Another possible impact on native south fork chinook salmon runs could be from extensive outplanting of hatchery fall chinook salmon from other watersheds. From 1956 to 1973, more than nine million fall chinook salmon fingerlings and fry from outside the watershed were planted into the North Fork and South Fork Stillaguamish (SASSI 1993). These outplanted fish may have interbred with resident south fork chinook salmon, reducing the genetic fitness of the local population.

Migration and Spawning Requirements

Chinook salmon spend the earliest and latest life stages in freshwater river and stream habitats. While becoming sexually mature, chinook salmon juveniles spend the majority of their time feeding in saltwater, then return to the river basins of their birth for reproduction. The freshwater requirements of chinook salmon are reasonably well known, although many subtle and important details of the freshwater life histories of specific stocks in the Stillaguamish watershed remain unknown.

Environmental conditions required during adult upstream migration include adequate water quality, quantity, and cover. Adults migrating upstream must have streamflows that provide suitable water velocity and depth for successful passage. The amount of flow in a channel can determine whether chinook salmon adults have access to areas of the river system traditionally used for spawning.

Substrate composition, cover, water quality, water quantity, and habitat area are important requirements for salmon before and during spawning. Healey (1991) suggested that fry and smolt production could be more related to the amount of good spawning gravel area than to the number of spawners. Chinook salmon primarily spawn in the North Fork Stillaguamish River and its larger tributaries including Squire Creek.

Flow, substrate condition, and redd depth appear to be important factors in incubation and emergence success. Important environmental factors during incubation include the level of fine sediment transported by the river and the frequency, duration, and magnitude of flood flows during incubation. More specifically, gravel size and percolation rate are two primary factors that influence the success of incubation and emergence.

On emergence from the redd, chinook salmon fry disburse, primarily at night. The rate of dispersal or migration is usually correlated with flow level. Juvenile chinook salmon are principally found in all mainstem areas, including side channels and larger tributaries. As chinook salmon fry migrate, they may inhabit the river's edge, backwater and off-channel habitats, side channels, or banks with cover (Healey 1991).

C. WATERSHED PROCESSES AND HABITAT CONDITIONS

1. Riparian

The riparian forest performs a number of important functions that affect the quality and quantity of salmon habitat. A properly functioning riparian forest provides shade and cover, stabilizes stream banks, controls sediment, attenuates flooding impacts, and contributes large woody debris (LWD) and other forms of organic matter. Other benefits include habitat for terrestrial wildlife and improved water quality. These functions are impaired as riparian forests are cleared or otherwise altered.

Historical Conditions

At the turn of the century, deciduous trees dominated the Stillaguamish River floodplain accounting for 63% of individual tree species; primarily red alder, black cottonwood, and big leaf maple. From 1870 to 1910, riparian timber harvest had removed most, if not all, large conifers on the mainstem, lower South Fork, and North Fork up to Rollins Creek (Collins 1997). A decade later, riparian forests in nearly all of Church Creek, much of Pilchuck Creek, lower portions of the North Fork tributaries, and the South Fork valley up to Granite Falls had been logged. By the 1940's, most riparian areas in the Stillaguamish watershed had been logged, with the exception of upper and middle Deer Creek and uppermost Jim and Canyon Creeks. Cleared land converted to agricultural and urban uses is still in that use and consequently little replanting has occurred.

Factors of Decline

Most of the impacts to riparian zones in the Stillaguamish watershed have been caused by the following actions:

- Deforestation. Removal of riparian vegetation associated with forest harvest practices has resulted in increased water temperatures and erosion along with less instream cover and food supply. Historic use of streams and rivers for transport of timber also resulted in significant impacts to riparian vegetation and large-scale landslides.
- Road and railroad construction and inadequate maintenance. Construction of roads and rail beds often occurred along riverbanks and included substantial bank armoring, fill, and vegetation removal. Poorly designed and maintained roads and associated culverts have substantially contributed to riparian degradation and large-scale landslides.
- Clearing of forests for agricultural and residential uses has diminished overall forest cover and ecological value of associated riparian areas.
- Dike, levee, and revetment installation. The installation of flood and erosion control structures has resulted in substantial modifications to riparian areas and off-channel habitat. Maintenance of these structures often includes vegetation removal.
- Livestock grazing and trampling of native vegetation. Unrestricted livestock access along riparian areas has led to significant degradation of vegetation communities.
- Noxious weeds. Noxious weeds suppressing beneficial native vegetation.

Current Conditions

A considerable portion of the historically forested Stillaguamish riparian zone is currently either of low quality or recently planted. A large portion of the lower floodplain is currently in agricultural use. GIS analysis of 2001 land cover data shows that just over half (52%) of the area within 300 feet of streams in the Stillaguamish watershed is forested with mature vegetation, as shown in Table 2 (Purser et al. 2003).

Table 2. Forested Riparian Cover within Stillaguamish Subbasins.

SUBBASIN	***Riparian Buffer Forest Cover (%)***	***SUBBASIN***	***Riparian Buffer Forest Cover (%)***
Gold Basin	79	Upper Pilchuck Creek	55
Upper SF Stillaguamish	79	French-Segelsen	50
Upper NF Stillaguamish	77	Middle NF Stillaguamish	48
Upper Canyon Creek	77	Harvey Armstrong Creek	39
Stillaguamish Canyon	72	Lower NF Stillaguamish	38
Boulder River	70	Lower Pilchuck Creek	36
Deer Creek	67	Lower SF Stillaguamish	34
Robe Valley	64	Port Susan Drainages	34
Jim Creek	57	Church Creek	20
Lower Canyon Creek	56	Portage Creek	19
Squire Creek	55	Lower Stillaguamish	16

2. Estuary/Nearshore

Estuaries (including marine nearshore areas) provide an important feeding area, cover for predator avoidance and a transition zone for young salmon to adapt to saltwater environments. Chinook salmon use estuaries for rearing with heavy use of blind tidal channels in estuarine salt marshes, tidal sloughs, eelgrass beds, and shallow shoreline areas. Chinook salmon fingerlings generally enter the estuary in the late winter or early spring and may reside in this environment until early fall. Growth during river and estuary residence is critical to marine survival for chinook salmon.

Historical Conditions

Prior to European settlement (circa 1870), there were approximately 4,439 acres of salt marsh habitat connected to the Stillaguamish watershed. By 1886 only one-third of the original salt marsh remained. By 1968, only 15% of the original salt marsh remained, with an associated loss in blind tidal channels. During the period from 1886 to 1968, approximately 863 acres of material was accreted into Port Susan and Skagit Bay (Table 3). The newly accreted sand and mud flats do not have the same well-developed channel system and do not provide the same habitat quality as the lost salt marsh (Collins 1997).

Table 3. Estimates of Historic and Current Salt Marsh Habitat Reclaimed by Dikes on the Stillaguamish River Delta and Newly Reclaimed Areas (Collins 1997)

Site	*1870 (Pre Settlement)*	*1886*	*1968 Original Salt Marsh*	*1968 New Salt Marsh*
-- Salt Marsh (in acres) --				
South of Hatt Slough	487	94	0	99
Stillaguamish Delta	1045	170	99	386
Leque Island	475	214	85	220
East of Douglas Slough	1293	211	114	0
West of Douglas Slough	673	496	369	0
Camano Island	466	292	0	158
Total	**4439**	**1477**	**667**	**863**
			1530 (Total 1968)	

Factors of Decline

Several factors have contributed to the loss of estuarine areas, including:

- Construction of dikes, levees, revetments, and bulkheads
- Increased sediment deposition due to upstream land uses
- Construction of road, railroad and utility crossings
- Installation of tide-gates, flood-gates, pump-stations, weirs, and culverts
- Removal of large woody debris
- Construction upon and deforestation of marine riparian areas
- Filling and draining of wetlands, including pocket estuaries
- Noxious weeds suppressing native vegetation, tidal processes and fish access.

Current Conditions.

The Stillaguamish watershed, as defined by Water Resource Inventory Area 5 boundaries, includes 22 miles of marine shoreline. Estuarine habitat in the watershed is constrained by cut-off sloughs, hardened banks, sediment deposition and invasive species. Accretion of sediment into Port Susan has resulted in over 1530 acres of mud/sand flats. The majority of this acreage does not have the habitat quality of historic salt march or tidal channels. Invasive plant species (e.g. *Spartina sp.*) are common and threaten to eliminate native marsh vegetation (Collins 1997).

3. Large Woody Debris

Cover is an important element in rearing habitat used by chinook salmon. Cover can be defined as depth, turbulence, large substrate, overhanging vegetation, undercut banks, woody debris, floating debris, and aquatic vegetation. In the Pacific Northwest, an important factor in complexity is large woody debris. Large woody debris (LWD) is generally meant to describe fallen riparian wood pieces that are large (e.g., often >50 feet in length or >24 inches in diameter) and are found in complex wood jams (NMFS 1996). Once they are instream, these wood pieces create more complex river channel habitats and aid side channel formation. LWD creates both micro and macro habitat features, and is an important component throughout the drainage network from headwater streams to estuaries. LWD helps collect gravel, reduce velocity, provide cover, and create habitat for macroinvertebrates that are food for juvenile chinook salmon.

Historical Conditions

Giant rafts of logs are described in the history of Puget Sound settlements and were once present in the lower Stillaguamish River. Six log raft jams were located in a 16-km stretch of the mainstem prior to the turn of the century (Collins 1997). Settlers removed all of the log raft jams, most likely to improve navigation and to allow for the settlement of upstream areas. Giant snags were also systematically removed from the lower mainstem for navigation purposes. By 1900, over one thousand snags and leaning riparian trees were removed, mainly downstream of Hatt Slough on the mainstem. The removal of the giant log rafts may have contributed to destabilization of the heads of floodplain sloughs, a decrease in the frequency and magnitude of overbank flooding, downcutting of the mainstem channel, and an increase in the amount of sediment reaching Port Susan (Collins 1997).

Factors of Decline

Changes in the amount of LWD available for recruitment and the ability for it to reach and stay in the channel have been caused primarily by the following factors:

- Deforestation. Clearing of riparian vegetation was commonly associated with early forest harvest practices, thus reducing the supply of wood to the river.
- Clearing of forested lands for agricultural and residential uses.
- Dike, levee, and revetment installation.
- Livestock grazing and trampling of native vegetation, limiting regrowth of riparian areas where LWD is recruited.
- LWD removal. Woody debris and snags are removed in order to improve navigation, floodwater conveyance, or to protect structures such as trestles and bridges.

Current Conditions

Instream wood has been documented from the confluence of the North Fork and South Fork Stillaguamish up to Squire Creek and to Granite Falls and in the Lower Stillaguamish. Table 4 presents LWD distribution data by subbasin.

Table 4. Large Wood Counts in 5 Subbasins (Haas et al. 2003)

SUBBASIN	*Main Channel Length Surveyed (miles)*[8]	*Pieces of LWD per mile*
Lower Stillaguamish	21.5	0.8
Lower SF Stillaguamish	16.2	1.3
Lower NF Stillaguamish	14.9	1.1
Middle NF Stillaguamish	9.5	0.8
French-Segelsen	7.2	8.3

[8] Survey data from the Lower Stillaguamish Includes Koch Slough and Hatt Slough but not the Old Stillaguamish Channel

4. Floodplain

Unconstrained floodplain reaches are some of the most productive habitats for anadromous salmonids. Off-channel areas adjacent to floodplains of larger rivers are important refuge habitats for salmonids to reduce competition and provide refuge during winter flood events. Fragmentation of habitat and the resulting isolation of populations impact the long-term viability of salmonid stocks.

River channels and their floodplains can be degraded and simplified by flood protection and drainage infrastructure. Such changes can result in reduced pool depth and frequency, loss of side channels and sloughs, restricted channel migration, and reduced floodplain connectivity. Each of these conditions reduces the amount and quality of salmon habitat.

Historical Conditions

The draining and filling of side channels along with hardening of stream banks has considerably reduced the quantity and quality of salmonid rearing habitat and biological productivity. Two-thirds of this damage to floodplain habitat occurred between 1870 and 1886 (Collins 1997).

Flood control activities dominated from 1930 to present and precipitated the loss of more than one-third of the channel area from 1933 through 1991. These measures decreased the area that could potentially receive floodwaters, increasing the cumulative potential for catastrophic floods downstream. In addition, United States Army Corps of Engineers' records from 1955 to 1965 show over 53 km (33 miles) of rip-rap placed within the watershed with the majority of it placed on the mainstem (Collins 1997).

Factors of Decline

The loss and degradation of in-channel and off-channel rearing habitat can be linked to processes that have been altered on a watershed scale, as well as processes and functions that operate proximally to rearing habitat. Several factors have led to the isolation of the river from its floodplain, primarily the following:

- Channelization or straightening of streams
- Bank protection or armoring (e.g. rip-rap),
- Levee and dike construction,
- Removal of snags, LWD and gravel
- Railroad construction

Current Conditions

The floodplain has been largely disconnected from the river through the placement of extensive flood control structures and by bank armoring. Table 5 indicates the total miles of modified (hardened) banks in listed subbasins.

Table 5. Modified Bank Data (Haas et al. 2003)

Subbasin	Bank Length (miles)	% Modified Bank	Miles of Modified Bank
Lower Stillaguamish	33.1	53%	17.5
Lower NF Stillaguamish	29.4	16%	4.7
Middle NF Stillaguamish	19.4	13%	2.5
French-Segelson	12.5	14%	1.8
Lower SF Stillaguamish	33.1	14%	4.6

5. Sediment

Sediment transported from upland areas and from within the channel determines the nature and quality of salmonid habitat in streams, rivers, and estuaries. The development and persistence of channel features used for spawning and rearing depends on the composition and rate that sediment is delivered (Spence et al. 1996).

In the freshwater environment, the quality (gravel size and fine sediment composition) and stability of chinook salmon spawning habitat are key factors affecting chinook salmon production. In general, fine sediment concentrations above 12% reduce the amount and quality of salmonid spawning and rearing habitats and specifically impact embryo survival and emergence success in chinook salmon. Levels at or below 11% are often encountered in relatively pristine habitats (Peterson et al. 1992).

Mass wasting in the form of landslides, earthflows, slumps, and creeps is a major component of sediment delivery to streams.

Historical Conditions

During 1997, a landslide inventory was completed for the Stillaguamish watershed. The inventory documented 1,080 landslides in the watershed between the early 1940s and the early 1990s, of which 851 delivered sediment to stream channels (Perkins and Collins 1997). Seventy-five percent of the 1,080 landslides were associated directly or indirectly with human disturbance, most commonly clearcuts (52%) or road construction (22%).

Factors of Decline

The following factors are the primary contributors to excessive sediment deposition in the Stillaguamish watershed:

- Eroded sediment from timber harvest and road construction
- Landslides caused by timber harvest, and
- Clearing of forests for agricultural and residential uses.

Current Conditions

Field observations of sediment impacts to spawning and rearing habitats of the entire watershed are common. Sediment sources are specific to large chronic landslides and discrete events, such as forest road failures, particularly in the North Fork Stillaguamish. Surveys of fine sediment in tributaries found that the Lower and Middle North Fork Stillaguamish River (29%), Lower Canyon Creek (14%), and South Fork Stillaguamish (30%) drainages exceeded fine sediment criteria (SWM 2002). Comprehensive data on precise sediment conditions in chinook salmon production areas has not been collected downstream of these tributaries.

Table 6 illustrates the extent of forest road networks that are underlain by unstable geology and built on greater than 30% slopes. The combination of unstable geology and steep slopes combine to present an increased risk of sediment routing to streams and rivers. Forest road density is an important indicator of watershed health. Forested areas with over two miles of road per square-mile may not have properly functioning sediment and water delivery to lower watersheds (NMFS 1996).[9]

Table 6. Forest Roads Data by Subbasin (DNR 2002)

Subbasin Information			Miles of Forest Roads with Unstable Geology and Steep Slopes > 30%[10]				% Of all Roads that are Unstable
Road Density (mi/mi^2)	Area (mi^2)	Name	Federal Lands	Private	State DNR	Total	
3.2	54.3	Upper North Fork Stillaguamish	35.65	6.72	5.43	47.80	28%
2.6	67.9	Deer Creek	4.04	8.67	2.77	15.49	9%
1.8	38.8	Upper Canyon Creek	11.95	0.44	0	12.39	18%
3.98	24.3	Robe Valley	7.24	3.69	0.12	11.06	11%
3.06	29.6	French-Segelsen	5.55	0.41	1.19	7.15	8%
3.92	47.0	Jim Creek	3.90	2.79	0.29	6.98	4%
1.5	54.8	Upper South Fork Stillaguamish	6.37	0.09	0	6.46	8%
1.74	29.3	Gold Basin	6.27	0.04	0	6.31	12%
3.45	35.8	Middle North Fork Stillaguamish	0	1.98	3.77	5.75	5%
4.43	24.4	Lower Canyon Creek	0	2.64	.01	2.65	2%
.56	25.8	Boulder River	0.07	0.28	1.74	2.09	14%
4.08	46.0	Upper Pilchuck Creek	0	0.80	0.97	1.77	1%
1.22	26.1	Squire Creek	0.48	0.03	0	0.52	2%
	478.1	**Totals**	**81.46**	**28.31**	**14.55**	**124.33**	

6. Hydrology

Patterns of streamflow are a critical part of creating and maintaining suitable habitat conditions. Natural streamflow patterns are strongly correlated with upper watershed forest cover.

[9] There are 1,876 total miles of roads contained in 13 subbasins dominated by forestry land uses: Upper North Fork Stillaguamish, Deer Creek, Upper Canyon Creek, Robe Valley, French-Segelsen, Jim Creek, Upper South Fork Stillaguamish, Gold Basin, Middle North Fork Stillaguamish, Boulder River, Upper Pilchuck Creek, Squire Creek, Lower Canyon Creek. These watersheds average a road density of 2.9 mi/mi^2.

[10] Slope-stability maps for the Puget Lowland of Western Washington often use 15% slope as a stability threshold based on a consideration of the mechanics of failure and shear strength of a silt-clay bed (Dunne & Leopold 1978). Table 6 shows only forest roads that are underlain by unstable geology and are traversing greater than 30% slopes. Site-specific analysis is always necessary to determine the specific stability of a particular roadbed or its contribution to sediment regimes in a watershed.

For chinook salmon to thrive instream flows must be sufficient for adult upstream migration, holding, and spawning requirements and juvenile incubation, emergence, and rearing.

The stability of chinook salmon spawning habitat is equally important. High flows can pick up spawning gravel and move it downstream, a process known as scour. The North Fork Stillaguamish River has shown a trend of increasing peak flows (Figure 7), both in frequency and magnitude, resulting in increased chinook salmon mortality (Collins 1997). More frequent flows have been attributed to land use practices such as clear-cut harvesting, road construction and rural development.

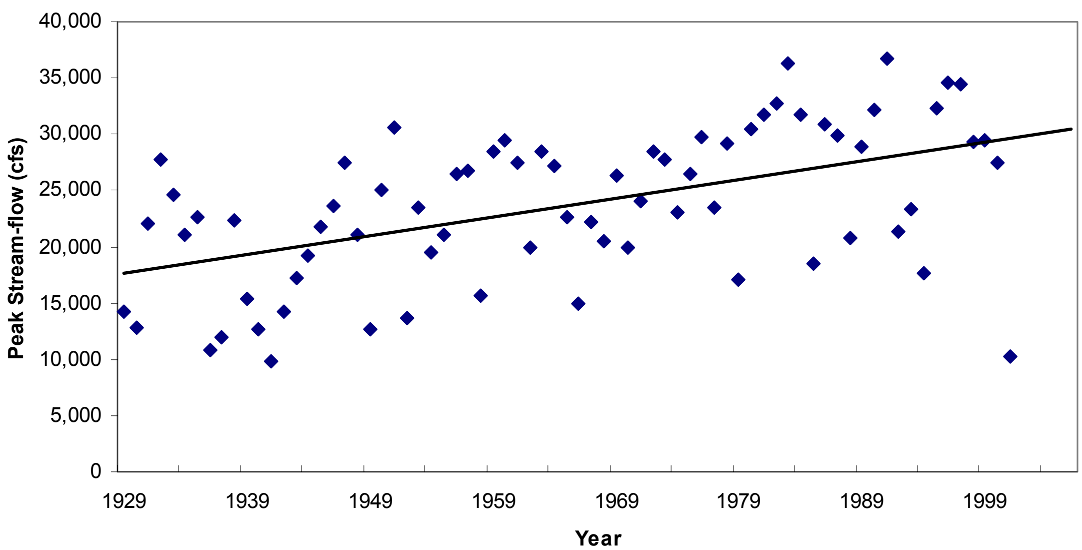


Figure 7. NF Stillaguamish peak flows summary 1920-2001. (USGS 2003)

Historical Conditions

Gauging records from the North Fork Stillaguamish show a systematic increase in peak flows over time (Figure 7). Ten of the largest eleven annual peak flows on record occurred between 1980 and 1995. This was a climatic period characterized as dryer and warmer for the Pacific Northwest. Urbanization (Klein 1979; Booth and Jackson 1997) and agricultural activities also result in an increase in the magnitude and frequency of peak flows in smaller tributary streams.

Factors of Decline

The factors of decline that have degraded hydrologic function in the Stillaguamish Basin include the following.

- Deforestation. Clearing of mature forest vegetation over large areas of the watershed has reduced the infiltration capacity of the landscape, thereby increasing runoff rates and peak flows.

- Filling and draining of wetlands and side channels that modify peak flows on tributaries.
- Construction of dikes, levees, revetments, and bulkheads on mainstem rivers that reduced or eliminated floodplain connectivity and flood storage.

Current Conditions

Streamflow is strongly influenced by the amount of rainfall that infiltrates to groundwater or is intercepted by forests and other vegetation communities. Infiltration and interception is most significant where adequate forest cover exists. Approximately 53% of the entire Stillaguamish Basin is forested, within a range of 14% to nearly 85% on a subbasin scale (Table 7).

Table 7. Forested Cover within Stillaguamish Subbasins (Purser et al. 2003)

SUBBASIN	% Young Forest (0-27 years)	% Mature Evergreen Forest	%Total Hydrologically[11] Mature Forest
Gold Basin	12	51	85
Upper Canyon Creek	12	43	82
Boulder River	11	49	75
Deer Creek	20	28	75
Upper SF Stillaguamish	16	40	72
Upper NF Stillaguamish	23	27	70
Robe Valley	24	27	66
Stillaguamish Canyon	22	15	65
French-Segelsen	25	25	64
Jim Creek	24	18	60
Upper Pilchuck Creek	27	14	60
Squire Creek	20	32	56
Middle NF Stillaguamish	32	14	56
Lower Canyon Creek	29	15	51
Lower NF Stillaguamish	31	8	45
Harvey Armstrong Creek	29	7	40
Lower Pilchuck Creek	39	3	38
Lower SF Stillaguamish	30	7	34
Port Susan Drainages	37	4	31
Church Creek	31	1	19
Portage Creek	30	1	17
Lower Stillaguamish	28	1	14

[11] Hyrologically mature indicates a combined deciduous and evergreen forest cover that produces an amount of runoff similar to the same watershed under native (historical) vegetative conditions.

Peak flow responses have shown a direct relation to the timing and extent of timber harvest on private, state, and federal lands along with the other factors discussed in this section (Pollock 1998).

7. Instream Passage

Salmon need to be able to pass freely under roads, railroads and other stream crossings. Improperly designed or placed culverts can block adult and juvenile fish migration, adversely affecting fish populations. Culverts more negatively impact salmonids (such as coho salmon, steelhead, and cutthroat trout) that depend on smaller tributary streams for spawning, rearing and migration than species (such as chinook, pink and chum salmon) that mainly rely on larger stream channels.

At this time, culverts are not definitively known to be blocking chinook salmon migration in the Stillaguamish. However, improving fish passage may be critical aspect of bull trout recovery and further analysis for this species is warranted.

8. Data Gaps

The following data gaps and recommended efforts are priorities on the critical path to chinook salmon recovery and adaptive management in the Stillaguamish River basin. This list is current as of February 2004 and is subject to change.

Riparian Function

- No known data gaps

Estuary

- Analyze juvenile chinook salmon use of estuarine and lower river habitat to identify the type of habitat used and timing.
- Undertake a baseline study of nearshore habitat conditions and usage by juvenile Chinook salmon, particularly in Douglas Slough and South of Hatt Slough.

Fine Sediment

- Monitor and develop a sediment budget focused on fine sediment source disturbance impacts on chinook salmon redds that reduces survival-to-emergence.

Large Woody Debris

- Survey LWD in Chinook salmon production reaches which have not yet been surveyed – 1) Jim Creek, 2) Pilchuck Creek, and 3) Deer Creek. Starting in 2005, resurvey reaches surveyed starting in 2000. Co-monitor pools and juvenile usage of wood structures.

Floodplain Connectivity

- Identify projects and willing landowners for future restoration and protection opportunities.

Hydrology

- Establish the effect of instream flows and water rights withdrawals on summer low flow conditions.
- Model stage/discharge under conditions of primeval forest and current conditions to explicitly determine changes in base-, mean-, and peak-flow as a result of forest cutting and type conversion. Assess where protection of forest hydrology would be most effective.
- Model effect of wetland degradation on base-, mean, and peak-flows and stages, particularly in lower river reaches; also combined effect considering hydromodifications.

Instream Passage

- Determine necessary improvements at the Granite Fall fish ladder for passage of chinook salmon at all flows.
- Survey tributary streams for suitable chinook rearing habitat near main channels where instream passage improvements are relevant.

General Salmon Biology

- Determine juvenile chinook salmon use of upriver rearing habitat and update determination of the mix of "types" which comprise the Stillaguamish runs so that critical habitat for projection may be established.

CHAPTER 4. VOLUNTARY HABITAT RESTORATION STRATEGY

The Technical Assessment and Recommendations for Chinook Salmon Recovery in the Stillaguamish Watershed prepared by the Stillaguamish Technical Advisory Group (STAG) in 2000. This report identified six main watershed processes or habitat components that were limiting chinook salmon production: estuarine/nearshore habitat, fine sediment, floodplain connectivity, riparian function, in-stream habitat, and hydrology. Resolving these limiting factors is the primary focus of this strategy to restore chinook salmon in the Stillaguamish watershed. Geographic priorities for projects addressing these limiting factors are shown in figures 9-11 at the end of this chapter.

The strategy for addressing the limiting factors is based upon identifying actions that would assist in restoring the properly functioning conditions (PFC's) for the watershed. Properly functioning conditions support the sustained presence of natural habitat-forming processes in a watershed. These processes are necessary for the long-term survival of the species through the full range of environmental variation. The STAG has defined PFC's for each habitat category.

The long-term survival of salmon in the wild depends upon the proper functioning of ecosystem processes that form and maintain habitat. Voluntary protection and restoration of habitat by public and private landowners in the watershed is an essential part of the strategy to recover chinook salmon populations in the Stillaguamish watershed.

The purpose of this chapter is to provide guidance for habitat protection and restoration projects using the habitat condition categories as an organizational tool. It is unlikely that actual projects will be designed to address only a single habitat condition or watershed process. Rather, most projects will address multiple factors and will need to refer to multiple sections below when developing a strategic project. Additional guidance on project types and cost is available from various sources.[12]

Successful projects in the Stillaguamish watershed undergo a rigorous assessment to determine whether their feasibility and design are appropriate to solve the problem and whether the project cost is in line with similar projects. 2004 evaluation criteria are in Appendix B.

Habitat Linkages

It is generally believed that unconstrained, aggraded floodplain reaches were once highly productive habitats for some anadromous salmonids (Stanford and Ward 1992). In addition, off-channel areas adjacent to floodplains of larger rivers have been shown to be

[12] For project types see: JNRC (Joint Natural Resources Cabinet). 2001. Guidance on Watershed Assessment for Salmon. Governor's Salmon Recovery Office. Olympia, WA. http://www.governor.wa.gov/gsro/watershed/watershed.pdf
For cost information see: EFC (Evergreen Funding Consultants). 2003. A Primer on Habitat Project Costs - Prepared for the Puget Sound Shared Strategy. Seattle, WA.
http://www.sharedsalmonstrategy.org/files/PrimeronHabitatProjectCosts.pdf

important rearing habitats for salmonids during high winter flood events (Tschaplinski and Hartman 1983). Fragmentation of habitat and the resulting isolation of populations affects the long-term viability of salmonid stocks. In addressing habitat fragmentation and connectivity for the Northern Spotted Owl, Thomas et al. (1990) outlined several general principles that are equally applicable to salmon recovery plans (Spence et al. 1996):

- Large blocks of habitat are preferable to small blocks.
- Blocks of habitat that are close together are superior to those that are far apart.
- Contiguous blocks are preferable to fragmented habitats.
- Interconnected blocks are better than isolated habitat blocks, and corridors linking habitats function better when they resemble the preferred habitat of the target species.

Thus, the first objective of a salmon recovery plan should be to prevent further fragmentation of aquatic habitat. This should lead to the second objective; improve the connectivity between isolated habitat patches. The third objective is to protect and restore areas surrounding critical salmon habitat from further degradation allowing for the expansion of existing refugia such as:

- Preferred spawning areas.
- Off-channel floodplain habitat.
- Remaining estuary and marine nearshore habitat.
- Complex sloughs and undisturbed blind tidal channels.
- Remaining natural riverbanks.

A. RIPARIAN STRATEGY

Properly Functioning Conditions Defined

The Stillaguamish Technical Advisory Group (STAG) defined properly functioning conditions (PFC's) for the Stillaguamish riparian zones as 80% of stream shorelines having a riparian buffer width greater than one Site Potential Tree Height (SPTH)[13] on fish bearing waters to ensure properly functioning riparian habitats (NMFS 1996, STAG 2000).

Approximately 8,000 acres of riparian area would need to be planted, restored, maintained and protected to achieve this standard in the nine subbasins that comprise the core chinook salmon production areas within the Stillaguamish watershed.[14] This calculation is based on analysis of 2001 landcover (Purser et al. 2003). Overall, the areas upstream of the core chinook salmon production areas exhibit more riparian function – see Table 2

[13] e.g. Site Potential Tree Height (SPTH) is 87-95 feet for Red Alder and 115 feet for Douglas Fir on common soil types found on the Lower Stillaguamish floodplain. Other soil types may yield higher or lower SPTH (USDA 1983).
[14] The key subbasins that contribute to the majority of chinook salmon productivity are: Lower Stillaguamish, Lower Pilchuck, Lower South Fork, Lower North Fork, Middle North Fork, Boulder River, French-Segelsen, Squire Creek and Upper North Fork. Other subbasins may contribute to overall ecosystem health or downstream chinook habitat but do not have significant chinook spawning habitat within them.

Riparian Actions

- Planting native vegetation in the riparian corridor.
- Removal and control of noxious weeds.
- Maintenance of existing vegetation communities in the riparian corridor.
- Streambank stabilization using native plants.
- Protection of intact riparian corridors.
- Pest control measures and exclusion of livestock.

Site Selection Criteria

This strategy recommends that riparian restoration and protection projects be prioritized based on stream reaches that meet all of the following criteria:

- Potential to restore basic riparian function in terms of reductions in water temperature, large wood recruitment, bank stabilization, cover and nutrients for salmon.
- Exhibiting the lowest percentage of properly functioning riparian forest cover and located in upper watersheds that will contribute favorably to the greatest area of downstream ecosystem conditions for chinook salmon.
- Predominantly in rural, urban and agricultural land uses and private ownership.[15]

Geographic Prioritization

The following reaches meet all the above criteria:

First priority reaches:

- French-Segelsen subbasin.
- Lowermost Squire Creek.
- Lowermost portion of Upper North Fork Stillaguamish River.
- Lower South Fork Stillaguamish River from Canyon Creek to Jordan Creek.

Second priority reaches:

- Lower Pilchuck Creek.
- Lower North Fork Stillaguamish River.
- Middle North Fork Stillaguamish River.

[15] Effective riparian restoration and management on state, federal and private industrial forestlands is a critical component of salmon recovery in the Stillaguamish. However, this criterion recognizes that most opportunities for community sponsored riparian restoration will not focus on state, federal and private industrial forestlands. Riparian policy and project implementation in these areas are administered according to established forest policies in federal and state laws as well as adopted habitat conservation plans such as the Forests and Fish HCP (see Edwards 2003).

B. ESTUARINE/NEARSHORE STRATEGY

Properly Functioning Conditions Defined

The Stillaguamish Technical Advisory Group (STAG) recommends that at least 80% of historic estuarine and nearshore habitat must be accessible and usable for properly functioning conditions (NMFS 1996; STAG 2000).

Based on research by Collins (1997), 3,500 acres of estuarine area would have to be restored to achieve this PFC target.

Estuarine Actions

- Protection of functioning estuary and nearshore habitat.
- Restoration or enhancement of blind tidal channels and salt marsh habitats.
- Shoreline restoration to remove bulkheads and enhance native vegetation.
- Dike setbacks to restore tidal processes and reestablish cut-off sloughs.
- Constructed log-jams to enhance tidal channel formation in the river delta.
- Removal of noxious weeds.
- Tide gate retrofits.

Site Selection Criteria

This strategy recommends that estuarine restoration sites be prioritized by selecting sites that meet multiple criteria:

- Adjacent to areas subject to frequent tidal or seasonal flooding.
- With evidence of historic blind tidal channel or salt marsh habitat.
- Nearshore areas bordering chinook salmon migration routes.
- Areas that provide chinook salmon habitat function as a transition zone from freshwater to salt water; a migratory corridor; opportunities to escape predation; and foraging opportunities.
- Areas with sustainable project development attributes such as large parcels; less developed parcels with less utilities, transportation or flood control infrastructure; and parcels with marginal economic uses.

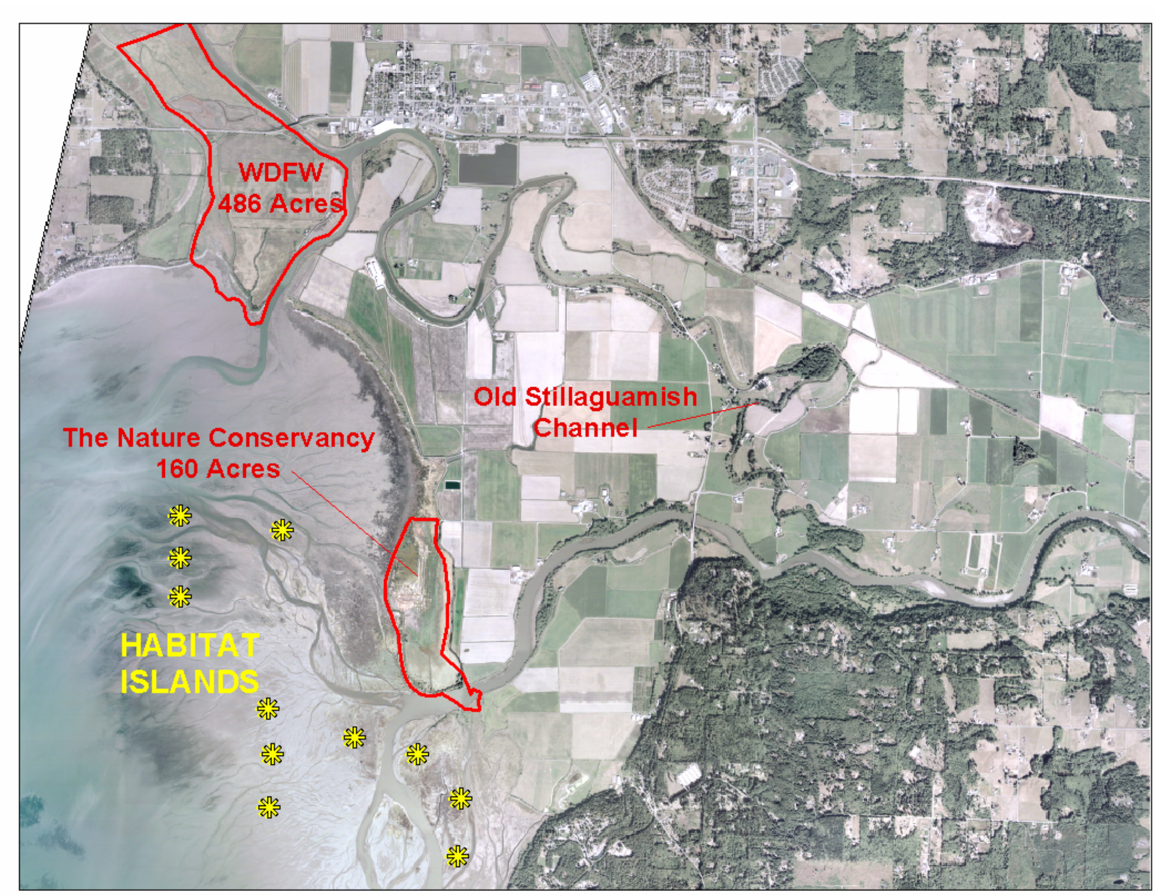
Geographic Prioritization

The SIRC has prioritized the following locations within the Stillaguamish watershed where estuarine protection or restoration projects would assist in returning properly functioning conditions (Figure 8):

- The 160 acre "upland" portion of the Old Groenveld Property owned by The Nature Conservancy.
- Lands owned by WDFW at Leque Island between South Pass and Davis Slough and South of Hwy 530.

- Areas identified by the Stillaguamish Flood Control District where economic uses are marginal and estuarine habitat can be restored without compromising flood control operations.
- The general area from the Old Stillaguamish Channel west and south to tidelands adjacent to Port Susan.
- The Hatt Slough delta where habitat islands may be constructed to encourage tidal channel formation.

Figure 8. Estuarine Priorities



C. LARGE WOOD STRATEGY

Properly Functioning Conditions Defined

The Stillaguamish Technical Advisory Group (STAG) has recommended that 80 pieces of large woody debris (LWD) per mile be maintained on mainstem rivers to ensure properly functioning instream wood conditions (NMFS 1996, STAG 2000).

Based on instream data gathered during 2002 from the North Fork and South Fork Stillaguamish, an additional 3,700 pieces of LWD (i.e. 24-inch by 50-foot pieces) would be needed to achieve the PFC standard in the 40 miles of these reaches. This is equivalent to approximately 62 engineered log-jams similar to those that have been built on the North Fork Stillaguamish with additional single pieces in the system.

Large Wood Actions

- Placement of engineered log-jams in mainstem rivers to enhance instream habitat.
- Use of large wood revetments or smaller structures to stabilize streambanks or attenuate landslides.

Site Selection Criteria

This strategy recommends that large wood pieces be placed in main channels by selecting sites that meet multiple criteria:

- To promote effective restoration of side channel connections, pool development and in-channel cover for chinook salmon, upstream of the confluence of the North Fork and South Fork Stillaguamish Rivers.[16]
- Where placement of large wood will also work to attenuate the effects of chronic landslides.
- In reaches where instream refugia are needed and connectivity between reaches can be established by filling gaps between areas that have more instream wood.
- In reaches where it will not jeopardize personal safety of residents or cause damage to private property.

Geographic Prioritization

The SIRC has identified the following locations within the Stillaguamish watershed as priority locations for LWD projects:

First Priority:

- Downstream of the confluence of Squire Creek to Fortson Ponds on the North Fork Stillaguamish.
- From Steelhead Haven to Deer Creek on the Middle North Fork Stillaguamish River.
- From Canyon Creek to Jordan Creek on the Lower South Fork Stillaguamish River
- From Deer Creek down to Grant Creek on the Lower North Fork Stillaguamish River.
- At the Gold Basin landslide on the South Fork Stillaguamish River.
- At the Steelhead Haven landslide on the North Fork Stillaguamish River.

Second Priority:

- From Grant Creek down through Cloverdale Park on the Lower North Fork Stillaguamish River.
- From Jordan Creek down to Jim Creek on the Lower South Fork Stillaguamish River.

[16] Areas upstream of the confluence present more favorable floodplain connectivity and instream conditions that make large wood placement more likely to produce habitat benefits. While the Lower Stillaguamish Floodplain lacks significant wood, is has more hardened banks that decrease the effectiveness of wood placement.

D. FLOODPLAIN STRATEGY

Properly Functioning Conditions

The Stillaguamish Technical Advisory Group (STAG) recommends that no more than 10% of streambanks in any reach be hardened to ensure adequate floodplain and off-channel connectivity (NMFS 1996, STAG 2000). The gap between current conditions and achieving this target in the North Fork and South Fork Stillaguamish is 4.1 miles of existing hardened bank.

Floodplain Actions

- Restoration of fish access to abandoned side channels and sloughs.
- Reconnection of floodplains and forested wetlands to main river channels .
- Dike setback and excavation to achieve either of the above.

Site Selection Criteria

Multiple criteria should be applied when seeking to restore floodplain sites:

- Provide juvenile rearing and adult holding capacity at a normal range of stream flows and to provide peak flow refugia with no chance of fish entrapment.
- Promote connections between existing intact floodplain habitats.
- Restoration of floodplain functions directly downstream of key spawning areas to improve conditions for all juveniles and particularly river-type chinook salmon.[17]
- Provide flood storage and mitigate peak flows, consistent with the Stillaguamish River Comprehensive Flood Hazard Management Plan (SWM 2004).
- Sites that exhibit sustainable or priority project features:
    - Identified by willing landowners where hardened banks may be removed.
    - Existing public or conservation organization ownership.
    - Low risk to life or property after the project is completed.
    - Project site has marginal economic uses or is threatened by development.

Geographic Prioritization

Using the above criteria, the following geographic areas within the watershed are priorities for floodplain restoration.

First Priority:

- From Deer Creek downstream to Cloverdale Park on the Lower North Fork Stillaguamish River
- From Jordan Creek on the Lower South Fork Stillaguamish River down to the Lower Stillaguamish mainstem.

[17] Currently 98 % of Stillaguamish chinook salmon smolts outmigrate as ocean-type and reside in the freshwater habitat for less than one-year.

- From the confluence of the North Fork and South Fork Stillguamish River to the Koch Slough confluence on the Lower Stillaguamish mainstem.
- From the confluence of Pilchuck Creek and the mainstem up to Stanwood Bryant Road

Second Priority:

- From Squire Creek down to Deer Creek on the North Fork Stillaguamish.

E. SEDIMENT STRATEGY

Properly Functioning Conditions

The Stillaguamish Technical Advisory Group (STAG) has defined properly functioning conditions as less than 12% (<6.35mm) concentrations of fine sediment in spawning areas (Bjornn and Reiser 1991, NMFS 1996, STAG 2000).

Sediment Actions

This strategy recommends restoration of natural sediment regimes be prioritized to address sediment sources where mass wasting or land use activities route fine sediment directly to streams. Sediment control projects include:

- Engineered slope stabilization to reduce direct inputs from chronic and deep-seated landslides that are active near main river channels.
- Targeted road decommissioning and treatment.
- Wetland restoration to stabilize small tributary sediment regimes.

Site Selection Criteria

The following criteria should be used when selecting sediment project sites:

- Where sediment routing has been documented from landslides or road networks.
- In areas identified by landslide hazard zonation maps.
- In subbasins with road densities greater than 2 mi/mi^2 in conjunction with greater than 5% of the total road network on unstable geology and traversing steep slopes (see Table 6).

Geographic Prioritization

The following areas are first priority for sediment projects.

- Steelhead Haven Landslide on the North Fork Stillaguamish River.
- Gold Basin Landslide on the South Fork Stillaguamish River.
- Forest road decommissioning in the Deer Creek, Upper North Fork Stillaguamish and Robe Valley, French-Segelson and Middle North Fork Stillaguamish subbasins.

F. HYDROLOGY STRATEGY

Properly Functioning Conditions

The Stillaguamish Technical Advisory Group (STAG) recommends that the cumulative subbasin total of immature forest (age class 0-27 years) be maintained below 12% of total forest cover (Nichols et al. 1990, STAG 2000).[18]

In the 13 subbasins dominated by forestry land use, 37,639 acres of immature forest would need to mature to achieve the target (Purser et al. 2003).[19] This assumes no net loss in existing mature forest cover. This assumption may be inaccurate given current land use pressures and forest management practices.

Hydrologic Actions

The following priority actions have been agreed upon by the SIRC for improving hydrological conditions to the North Fork Stillaguamish watershed where the record has shown increasing magnitudes of peak flows over time:

- Restoration of floodplains (including wetlands) to increase infiltration, slow runoff, and reduce downstream peak flow impacts.
- Development of strategies that protect large blocks of mature forest in subbasins with significant immature forest.

Site Selection Criteria

- Floodplain and wetland restoration in higher elevation watersheds upstream of chinook spawning areas impacted by peak flows.
- Forest protection strategies in the rain-on-snow zone (1000-3000 ft).

Geographic Prioritization

The following area is a prioritized for projects addressing the hydrologic regime:

- Restoration of floodplains including significant connected wetlands from Squire Creek to Deer Creek on the North Fork Stillaguamish River.

[18] Target is <12% of "young forest". Young forest is considered to be tree stands 0-27 years old.

[19] Subbasins dominated by forestry land use are: Upper Pilchuck, Upper South Fork, Gold Basin, Robe Valley, Upper Canyon Creek, Lower Canyon Creek, Jim Creek, Upper North Fork, Boulder River, French-Segelsen, Squire Creek, Deer Creek and Middle North Fork.

G. FISH PASSAGE

Properly Functioning Conditions

The Stillaguamish Technical Advisory Group recommends that human-made structures allow juvenile and adult fish passage to >90% of historical habitat at all flows.[20]

Fish Passage Actions

- Replacement of undersized culverts or other instream or diversion structures which impede fish passage

Site Selection Criteria

- Provides for improved chinook (or bull trout) migration to spawning or rearing.
- Removes the potential for imminent catastrophic failure of a structure and the associated instream, sediment or hydrologic impacts.

Geographic Prioritization

At this time (February 2004), no known instream blockages have been identified as impediments to chinook salmon (or bull trout) spawning or migration. The function of the Granite Falls fish ladder should be investigated. If deficiencies are found, they should be remedied immediately. There is anecdotal evidence that this structure may limit passage during upstream migration of spawning South Fork chinook salmon during summer low flows.

No instream structures are known to be at risk of catastrophic failure. This does not preclude their existence. Project feasibility analysis that clearly shows a site that meets either of these criteria would lead to that site being considered a first tier priority. Subsequent analysis of project proposal specifics would then determine overall priority in conjunction with other proposed projects.

H. COMMUNITY ISSUES

Successful habitat protection and restoration proposals are always based on sound science and adequate feasibility analysis. However, a supportive community is often the key to voluntary efforts that depend on willing landowners. In the larger context, salmon recovery will depend on the support of the citizens that live in the Stillaguamish watershed as much as the comprehensive technical information on salmon life history or habitat needs described above.

The following is a brief overview of relevant community issues that will be explored in more detail by the Recovery Plan chapter, which is due in June 2004. The Stillaguamish

[20] Adapted by the Stillaguamish Technical Advisory Group from NMFS 1996.

Implementation Review Committee (SIRC) has and will continue to address these issues in its work and use socio-economic criteria to evaluate projects.

Agricultural Viability

The viability of local Stillaguamish agricultural operators is no different than others in the Puget Sound region. National and regional markets have both forced lower prices and created new opportunities. However, net farm incomes are declining and are negative for many producers. Some regulatory programs to meet water quality standards have also put additional constraints on operators.

The viability of local agriculture is vital to salmon recovery. Many key stream and river habitats in the Stillaguamish watershed are on or near agricultural lands. Incentives must be in place to allow farmers to participate in salmon habitat restoration and protection. Without these incentives, farm owners may sell their property and agricultural lands will be developed to more intensive residential and commercial uses. These new uses are potentially greater obstacles to salmon recovery and ecosystem restoration.

Floodplains

While floodplains provide both important habitat features and components of hydrologic function critical for salmon, they are also the location of some of more intensive land uses in the watershed. The ability for upstream floodplain storage to reduce flood impacts downstream is important to the Stillaguamish community and the SIRC. Therefore, restoring connections between the river and its floodplain is also viewed by the SIRC as an opportunity to reduce the impact of floods downstream on human infrastructure. This is particularly relevant in the lower reaches of the North Fork and South Fork Stillaguamish.

Water Quality

Initiatives to protect and restore water quality were the foundation of the SIRC. Efforts continue to develop cleanup plans for impaired waterbodies and to address failing septic systems. Some water quality issues, such as sediment and temperature, are closely linked to salmon recovery. The Stillaguamish community has worked hard for 15 years to clean up the watershed for all citizens. It is an objective of the SIRC that parallel efforts continue on water quality initiatives while salmon recovery work progresses.

Tribal Fishing Rights

The Stillaguamish Tribe of Indians has a deep cultural and economic stake in viable salmon populations. Rights to fish for salmon are protected by federal treaty and have been verified by subsequent court decisions. Because stocks are so depressed, the Stillaguamish Tribe has not had a directed chinook salmon fishery in the watershed for over two decades. The Tribe will continue to be a key partner for salmon recovery and one with a special stake in it success.

Forestry

Forestry land uses cover more than 70% of the Stillaguamish watershed. The scale of historic forest harvest activities and how forestry was historically practiced have contributed significantly to the decline in local salmon populations. In the future, timber harvest, forest road building and forest practices on steep slopes and riparian areas need to be conducted with full consideration of habitat conditions. Recent changes to the Washington State forest practice rules are encouraging. However, new forest practices must be funded, implemented and monitored if the changes are to be effective.

Land Use Regulation

Voluntary habitat protection and restoration will not be effective if environmental degradation continues due to population growth and urban/suburban development. Poaching and destruction of habitat due to easy river access are persistent problems. Adequate enforcement of existing local land use regulations must co-exist with voluntary actions to restore habitat and growth management policies designed to protect habitat.

Growth management allows cities such as Arlington and Stanwood to expand within their urban growth areas. Managed growth, in the forms of satellite and commercial development, and rural residential land use tends to erode habitat function in a patchwork manner and presents recovery challenges. Despite the intent of GMA, mixing high and low-density land uses can deter watershed-based planning and restoration efforts.

Consistency in development regulations and enforcement will continue to be a major salmon recovery issue. Given past land use planning in the region, salmon recovery efforts may need to recommend new policies and enforce existing regulations to protect habitats, rather than creating overly complex and cumbersome legal frameworks.

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6. APPENDICES

APPENDIX A – STILLAGUAMISH IMPLEMENTATION REVIEW COMMITTEE

1. Background

The SIRC was established as a local stakeholder group in the early 1990s to oversee implementation of the 1990 Stillaguamish Watershed Action Plan. The Action Plan included seventy-one recommendations for controlling non-point source pollution in the Stillaguamish watershed. Twenty-one state agencies, local governments, tribes, and interest groups confirmed their commitment to implement the recommendations by signing statements of concurrence. Most of these original recommendations have been implemented, including the creation of the Lower Stillaguamish River Clean Water District to address water quality and water quantity issues.

In the mid 1990s, with leadership from the Stillaguamish Tribe and Snohomish County, the SIRC began addressing salmon habitat restoration issues in the Stillaguamish watershed. Since 1999, the SIRC has served as the local citizens committee for recommending prioritized lists of salmon habitat restoration projects to the Washington State Salmon Recovery Funding Board. The SIRC has final oversight authority for lead entity products, including salmon habitat project lists and the habitat restoration work schedule. Snohomish County and the Stillaguamish Tribe facilitate this oversight authority to the SIRC, and together serve as the Stillaguamish Lead Entity. Through a grant from the Washington Department of Fish and Wildlife, the County and Tribe provide staff and the Stillaguamish Lead Entity Coordinator.

The SIRC is also the local forum for public input on Snohomish County's long-term salmon conservation planning effort for the Stillaguamish watershed. The SIRC will continue to implement the approved plan and will address future problems as they arise at a watershed scale.

2. Mission Statement

Adopted by consensus November 15, 2000

> The mission of the SIRC is to maintain a healthy, functioning Stillaguamish Watershed by providing a local forum in which agencies, organizations, communities, and the public can engage in a collaborative watershed based process of decision-making and coordination.

3. Guiding Principles for the Stillaguamish Salmon Conservation Plan

Watershed Priorities Subcommittee - August 20, 2002

- <u>Integration</u>: The plan shall address water quality and salmon recovery issues in an integrated manner, consistent with the intent of the 1990 Watershed Action Plan and the origins of the SIRC.

- Fairness: The plan shall promote fair treatment and shared burden of cost for rural, urban, business, private, local, state, federal and tribal constituencies.
- Science: The plan shall use the best available science to make technical determinations. Existing watershed plans and analyses should be used as the core basis of this planning information. At the request of the SIRC, the Stillaguamish Technical Advisory Group will evaluate disagreements on best available science.
- Scope: Chinook salmon recovery shall be the primary emphasis of the plan within a broad ecosystem restoration context designed to enhance the watershed for all native freshwater and marine aquatic fisheries.
- Evaluation: Recovery shall be measured by criteria that are broadly accessible and that promote sustainability as well as fish population targets or water quality standards.
- Community: Recommended planning actions shall integrate scientific principles with community, social and economic values including but not limited to the protection and preservation of agriculture and rural quality of life. Community resources, such as volunteers, landowners and local knowledge, should be a part of plan implementation.
- Land Ownership: All landowners holding farm, forestry, recreation and residence properties may request fair compensation for the use of their land in restoration.
- Regulation: The plan shall seek to support actions that improve enforcement of current growth management and environmental regulations and make them more effective rather than proposing new regulations. Non-regulatory efforts that promote salmon recovery are necessary elements of the plan.
- Commitment: Actions shall be backed by financial and work plan commitments of implementing organizations and shall be designed to have measurable results.
- Education: Communication of problems, proposed actions and results to all ages of the public shall be defined as part of plan implementation in order to facilitate public comment and plan development.
- Cooperation: The plan shall recognize the individual efforts of agencies and organizations and promote cooperation among them.
- Balance: The plan shall balance long-term goals while recognizing the need for short-term actions.

4. SIRC Goals and Objectives

Approved by Consensus - April 9, 2003

1) Restore natural ecosystem processes and properly functioning conditions throughout the watershed.

Objectives:

- Increase wild chinook salmon and bull trout populations to self-sustaining and harvestable levels.
- Work towards self-sustaining and harvestable stocks of all salmonids.

- Maintain upland, aquatic and riparian habitats at sustainable levels for all native wildlife and fish species.
- Work to meet state and federal surface water quality standards.
- Share costs fairly among all partners and constituencies.
- Promote cooperation and coordination among project partners.
- Encourage the effective enforcement of existing environmental regulations.
- Apply scientific principles to solve natural resource problems.
- Promote efficient solutions to natural resource problems.

2) Maintain local stakeholder control of natural resources decision-making.

Objectives:

- Respect cultural values and traditions of watershed communities.
- Promote education and outreach to citizens.
- Respect the rights of private landowners.
- Promote viability of natural resource based industries.

5. Membership as of February 23, 2004

City of Arlington *
Bill Blake, Chair

City of Stanwood
Stephanie Cleveland (John Everett, Alt.)

Clean Water District Board
Orin Barlond (Norma Arnold, Alt.)

Dairy Farming
Vacant

Mainstem Stillaguamish
Carolyn Henri

North Fork Stillaguamish
Jim O'Neill

Pilchuck Audubon Society
Jon Baker

Recreational Fishing
Brian Simonseth (Gordon McKay, Alt.)

Snohomish County Council
John Koster (Larry Stickney, Alt.)

Snohomish Conservation District
Jenny Baker (Lois Ruskell, Alt.)

Snohomish County Noxious Weed Board
Sonny Gohrman

Snohomish County Planning and Development Services *
Larry Adamson (Randy Middaugh, Alt.)

South Fork Stillaguamish
Kristin Jagelski

Stillaguamish Flood Control District
Chuck Hazleton (Max Albert, Alt.)

Stillaguamish Grange
Franklin Hanson

Stillaguamish Tribe*
Pat Stevenson, Vice Chair (Jason Griffith, Alt.)

Stillaguamish Snohomish Fisheries Enhancement Task Force
Ann Boyce

Twin City Foods
Mick Lovgreen (John Anderson, Alt.)

Tulalip Tribes *
Kurt Nelson

US Forest Service *
Terry Skorheim (Karen Chang, Alt.)

Washington Dept. of Ecology
Sally Lawrence

Washington Dept. of Fish & Wildlife *
Mike Chamblin

Washington Dept. of Natural Resources
Vacant

Washington Farm Forestry Association
Duane Weston

WSU Cooperative Extension
Vacant

* Denotes Technical Advisory Group Member

APPENDIX B – 2004 EVALUATION CRITERIA FOR WRIA 5 PROJECT PROPOSALS

The SIRC project scoring subcommittee (the reviewers) will use the following criteria to evaluate all final applications using the approved SRFB application. Total project evaluation scores will be comprised as follows: Benefit to Salmon - 65%, Certainty of Success - 20%, and Socioeconomic Impacts - 15%. There are 5 to 8 sub-criteria listed that define each evaluation category. While the SRFB application does directly address all sub-criteria and some may not be relevant for all protect types, reviewers will be using the sub-criteria under each score category to provide a comprehensive evaluation of the whole SRFB application.

Sponsors should be clear and succinct when filling out the SRFB application and document assertions when necessary. Reviewers will not give the benefit of the doubt to incomplete or vague descriptions.

Benefit to Salmon (65 %)

Benefit to salmon will be evaluated based on sponsor documentation that establishes the project intent to:

- Improve the abundance, diversity, and distribution of chinook salmon.
- Protect and reconnect habitat for multiple salmonid species.
- Protect and restore natural ecosystems processes.
- Solve the cause of the problem, not the symptom.
- Be relevant over a broad geographic area.
- Respond to documented watershed priorities based on the lead entity strategy, salmonid limiting factors, watershed analyses, plans, and research.
- Address an information need that is crucial for understanding the watershed.
- Clearly lead to future projects of high benefit as defined above.

Certainty of Success (20 %)

Certainty of Success will be evaluated based on sponsor documentation that establishes the project intent to:

- Be completed within 2-3 years or within a scientifically defensible period if longer.
- To produce a complete site plan or feasibility study (if necessary to the project) within one-year of approved funding.
- Require limited maintenance, work with natural ecosystem processes, and be self-sustaining.
- Be designed for implementation with methods, and materials appropriate in scale and complexity to efficiently accomplish the work
- Be designed for post-project monitoring consistent with existing monitoring systems
- Be consistent with a land management plan that will direct the stewardship of the property.
- Build on previous habitat projects on site or nearby.

Socioeconomic Impacts (15 %)

Socioeconomic Impacts will be evaluated based on sponsor documentation that establishes the Project intent to:

- Build community support in terms of volunteer contributors and/or local partners.
- Make effective use of matching funds.
- Pursue the least cost alternative to achieve the desired outcome.
- Produce secondary community benefits such as increased public safety, decreased risk of property damage, or improvements to physical infrastructure.
- Enhance community education and outreach about the watershed.